VOLCANIC FEATURES IN VALLES MARINERIS REEXAMINED WITH MGS DATA. B. K. Lucchitta, U. S. Geological Survey, 2255 N. Gemini Dr., Flagstaff, AZ 86001. blucchitta@usgs.gov

Introduction: Viking images showed possible young volcanic deposits inside the Valles Marineris [1]. Some of these features are now covered by Mars Observer Camera (MOC) narrow-angle images at resolutions of only a few meters per pixel, and a new look is warranted. The features discussed in the earlier paper [1] were dark spots or bands at the base of trough walls, rimless craters, and a late hummocky, light colored deposit locally associated with flow lobes.

Dark spots and cones: A north-south-trending trough that connects Ophir Chasma with Candor Chasma is lined by dark materials, locally clustered in dunes. Dark, cone-shaped structures in parallel rows were barely recognized on top of a low mesa in this trough [1,2] (Fig. 1). A MOC image shows the area in detail and reveals a line of circular and oval depressions situated on dark ridges. The structures resemble volcanic fissure vents and support the notion that much of the abundant dark material in this region is locally derived. The circular depressions are younger than the light interior deposits and the low mesa, and perhaps even younger than a set of fresh-looking landslides that shed debris into this region [3].

Dark bands: Dark outcrops line the base of the south wall of west Candor Chasma and a spur separating Ophir Chasma from Candor Chasma. Many MOC images cover these outcrops. Unfortunately, most of them are so dark that no morphologic detail can be seen. The low albedo suggests little contamination with lighter material derived from the trough walls or nearby interior deposits [4]. A lack of associated dark dunes makes it unlikely that the material is a wind deposit funneled along the base of the trough walls. The dark material covers the lower wall-rock spurs, which suggests that the material could be a thin veneer, but in some places it appears to be massive and composing the spurs. A volcanic origin for the dark material is suggested by associations with some flow lobes (Fig. 2) and by an irregular depression that could be a caldera. Mars Observer Laser Altimeter (MOLA) measurements show that the elevations of the dark bands at the base of the trough walls rise and fall in concert with the elevations of the adjacent trough floors. This configuration supports an alignment of the dark material along faults. It is less compatible with an interpretation of the dark material as a basal layer in the trough walls. The association with faults also supports a volcanic origin.

Light-colored, nested craters: Viking images showed a circular crater inside an oval depression at the west end of east Candor Chasma. Lucchitta [1] suggested that these depressions may be volcanic explosion craters. One half of the inner crater, which is about 6 km in diameter, is covered by a MOC image. MOLA data show that the crater has a very subdued rim, yet it is 600 m deep with steep walls showing well-exposed layers. The fresh-looking inside suggests that the crater is young, yet the lack of pronounced ejecta or secondary craters contradicts an origin by relatively recent impact. The crater remains as a strong candidate for origin by volcanic explosion.

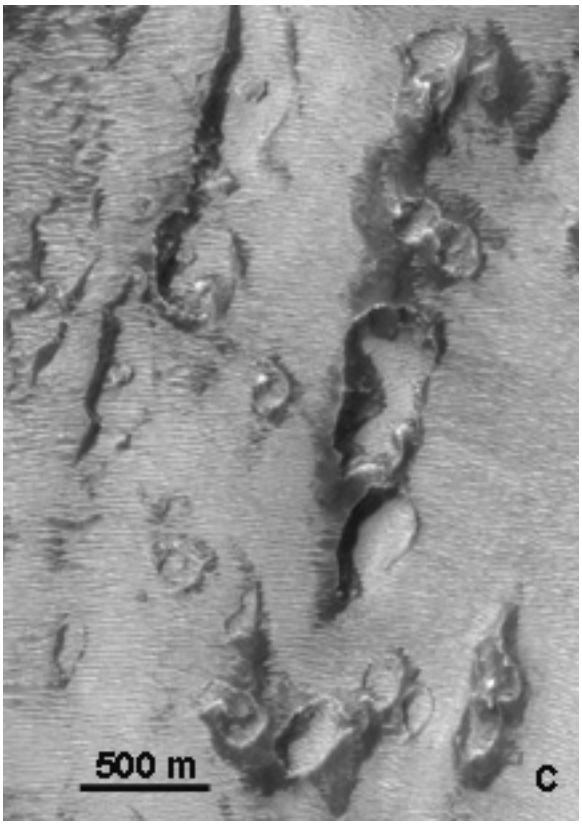
Late light hummocky unit: Ceti Mensa in west Candor Chasma is surrounded by a light, hummocky unit, which was interpreted as a late interior deposit, possibly of volcanic origin [1]. MOC images show this unit to be composed of highly contorted alternating light and dark layers, resembling volcanic ash deposits in Iceland. On the other hand, the unit appears to be locally associated with huge flow lobes, containing light colored rounded plates and emerging from the top of Ceti Mensa, the highest point in west Candor Chasma [5]. The lobes emanate from the top layer on the mensa, which is broken up by joints in the source region, suggesting that the material is derived from disintegrating interior deposits. Smaller flow lobes are clearly composed of fractured and broken up layers. Thus it appears that the younger material surrounding Ceti Mensa may be mass wasted from the older stacks. Why the material flowed is not known. High heatflow from volcanic activity in the vicinity [6] and incorporation of ice layers in the interior deposits may explain the disintegration and flow.

Light plateau unit: The Valles Marineris rim in many places is underlain by a light-colored unit. Treiman et al. [7] explained this unit as a weathering rind on older plateau lavas. MOC images show that the unit is composed of light colored layered material. In one place this material is seen to form a flow lobe emerging from a vent. The observation strongly suggests a volcanic origin for the unit [8]. Thus the thesis of Chapman and Tanaka [9] is supported, which proclaims that the subduing units in Xanthe and Margaritifer Terrae are composed of volcanic materials. The investigation also supports that the layered deposits associated with the hematite unit of Meridiani Terra are of volcanic rather than aqueous origin [9,10].

Conclusion: Overall, MOC images reaffirmed that the young dark units inside the Valles Marineris are best interpreted to be of relatively late, mafic, volcanic origin. The light plateau units are most likely volcanic, but the later interior deposits may well be mass wasting deposits derived from older interior mesas. Yet, their mobilization is most likely associated with high heatflow related to late volcanic activity.

References: [1] Lucchitta, B.K. (1990) *Icarus, 86,* 476-509. [2] Chapman M.G. and Tanaka, K.L. (2001) *JGR* 106(E5), 10,087-10,100. [3] Lucchitta, B.K. (1987) *Icarus, 72,* 411-429. [4] Lucchitta, B.K. (2002) *LPS XXXIII*, Abstract # 1636. [5] Skilling I.P. et al. (2002) *LPS XXXIII,* Abstract # 1361. [6] Geissler, P.E. et al. (1990) *JGR. 95,* 14399-14413. [7] Treiman, A.H. et al. (1995) *J. Geophys. Res, 100*, 26339-26344. [8] Lucchitta, B.K. and Chapman, M.G. (2002) *LPS XXXIII*, Abstract # 1689. [9] Chapman, M.G. and Tanaka, K.L. (2002) *Icarus, 155,* 324-339. [10] Hynek, B.M. et al. (2002) *JGR, 107,* E10, 5088.

Figure 1: **A**. Viking Orbiter image 815A50, showing a mesa topped by dark ridges with aligned cones. Located in trough connecting Ophir and Candor Chasmata. **B** and **C**. Excerpts showing that cones are topped by oval and circular depressions, most likely fissure vents. (MOC E02-02863, courtesy of Malin Space Science Systems).



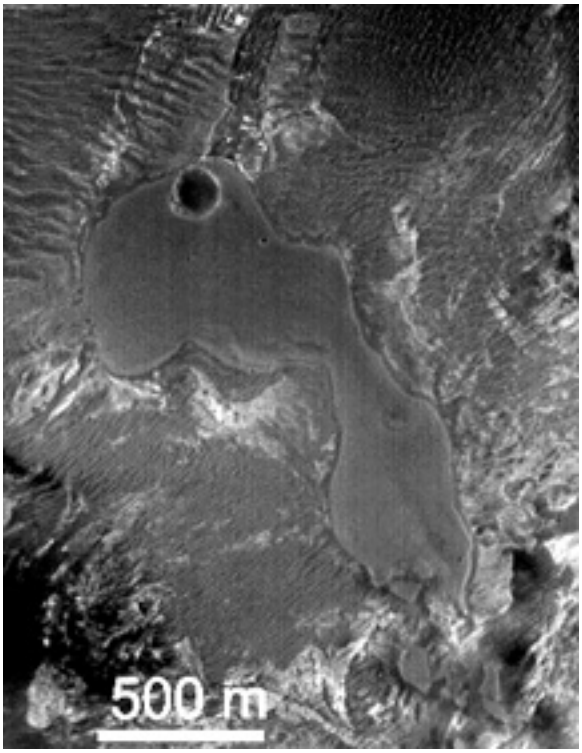


Figure 2: Crater with flow in Ophir Chasma. Located in dark area lining the base of the wall rock spur separating Ophir from Candor Chasmata. (MOC image M15-00067).